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ABSTRACT

This study investigated the potential individual and combinatorial effects of learning strategy training and ability on children's acquisition of new concepts, and considered whether use of the generation of examples strategy would transfer to new concept lessons once the training had been completed. Subjects were 178 sixth grade students who were divided into three groups: (1) explicit training (ET) treatment group, in which subjects were taught to generate their own examples; (2) informed directions (ID) treatment group, in which students were merely directed to make up their own examples of the concepts taught; and (3) no training (NT) treatment group, in which students received no training in or information on strategy use. In addition to training for the first two groups, all three groups took part in transfer sessions designed to test and compare the effects of transfer of the learning strategy training for the two experimental groups with performance by the NT groups. Posttests showed that while the ET group scores were slightly higher than the ID group scores in the training session, there was no statistically significant difference among treatment condition posttest scores. The ET group used the learning strategy in the training session, but showed a significant drop in strategy use during the transfer sessions. The use of learning strategy was minimal by the ID group and almost nonexistent for the NT group. In addition, ability was found to correlate significantly with performance, but no significant difference was found in strategy use between high and low ability students. The text is supplemented by five tables and one figure. (57 references) (EW)

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# TRAINING CHILDREN TO USE LEARNING STRATEGIES TO IMPROVE THEIR ABILITY TO ATTAIN CONCEPTS

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# Training Children to Use Learning Strategies to Improve Their Ability to Attain Concepts

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Paper presented at the 1988 Annual Convention of the Association for Educational Communication and Technology, New Orleans, LA.

Interest in learning strategies stems from a real concern for the academic performance of students. Whether the cause is poor teaching methods, inadequate curricula, or their own indifference, students are failing to succeed in the classroom, and the problem is widespread and severe. The Nation At Risk (NAR) and the National Assessment of Educational Progress presented discouraging news to educators. The reported results revealed that some 23 million American adults are functionally illiterate, 28 percent of high school students cannot read with literal comprehension and 51 percent cannot write letters. In addition, the studies showed a steady decline in the overall performance in high order thinking skills over the last two decades. Students were, on the whole, unable to read, write or comprehend at standards established more than twenty-five years ago (The National Commission on Excellence in Education, 1984; Task Force on Education of Economic Growth, 1983).

Based on the findings, Paul Copperman concluded that:

"for the first time in the history of our country, the educational skills of one generation will not surpass, will not equal, will not even approach, those of their parents" (p.11).

Other contributors to the Nation At Risk study concluded that "the educational foundations of our society are being eroded by a rising tide of mediocrity that threatens our very future as a nation and a people" (p.5).

## The Demand for Reform

To stem the "tide of mediocrity" and stop "the erosion of the educational foundations," the NAR Commission recommended such reforms as more rigor in the curriculum, higher standards of performance and expectations, lengthening the school day and year, and making more effective use of time during the school day.

The NAR Commission further claimed that these reforms could be largely accomplished through the children's own efforts. This suggests that it is up to the student to perform to his or her utmost ability in order to succeed in the new, more rigorus, classroom. Yet at the same time, this increased effort is being asked of the very same children who are at an all time low in school achievement.

Leaving it up to students to adapt to the more rigorus classroom is more likely to lead to failure than success. B.F. Jones (1986) argues that the demand for rigor without an accompanying emphasis on improving the quality of instruction will increase the number of failures at all levels of schooling" (p.6). Resnick (1984) also voices concern that the calls for reform may lead to a widening of the gap between high and low achievers. Efforts must be made to develop quality instructional programs for both high- and low- achieving students. Without proper guidance, it is doubtful that students will succeed in this endeavor (Jones, 1986).

The success or failure of students in the learning process may also depend on their own skills in activating learning strategies relevant to the instructional task. It has been found that effective learners spontaneously generate and use specific strategies when interacting with the instructional materials (Anderson, 1980a; Herber, 1978). In contrast, novices and low achieving students do not generate strategies spontaneously (Rohwer, 1980). The ability to assimilate these strategies and apply them to a variety of instructional tasks may improve students' performance in the classroom.

While educators often assume that students know how to approach and optimally manage their own learning, this may not be the case. In reality children need to be taught to learn and to use new information and skills efficiently. One possible way of meeting this need is to provide explicit instruction in the use of learning strategies that help children in their acquisition of new concepts.

## Background of the Study

### Learning Strategies

Learning strategies are those self-generated methods that students use to process information for later retrieval. Common strategies include mnemonics, rehearsing, paraphrasing, imagery (Weinstein, 1979; Pressley, 1984; Brown, 1980; Rigney & Munro, 1981). Recent research, however, suggests that not all students generate or use appropriate strategies, but instead tend to rely upon those which are familiar or easy to use (Weinstein, 1978,

1981; Brown & Smiley, 1978; Rigney, 1978; Rohwer, 1980; Battig, 1979).

Battig (1979) states that there is wide variation in students' abilities to generate and use strategies. Shuell (1980) suggests that an individual's learning strategies, once aqcuired, are relatively constant and stable. Once a particular strategy is learned, it then can become a stable factor within the learner for his or her own use.

Training of Learning Strategies

The purpose of providing instruction on learning strategies is to make specific strategies and methods available to individuals (Weinstein & Mayer, 1985). Furthermore, Rigney (1980) maintains that the purpose of training is to insure that such strategies facilitate rather than interfere with learing, and that they displace the less efficient strategies already in use.

In order to assist learners in achieving those purposes, researchers have begun to investigate ways to train learners to use strategies. To date, research has explored the explicitness of training procedures. However, while there are some common training procedures, they may vary according to the design of the training program and whether strategies are taught singly or in combination.

Explicitness is the type and quantity of directions on strategy use provided within the training. For example, Weinstein and associates (Weinstein, Cubberly, Wicker, Underwood, Roney, & Duty, 1981) reported several studies which investigated the effect of two versions of training over no strategy training. Two types of instruction occurred, informed and explicit. Informed training described the learning strategy and advocated its use while the explicit training included direct instruction on strategy use, examples with practice, and corrective feedback. The results significantly showed that explicit instruction was more effective than the informed version and that both were more effective in improving posttest performance than no training at all.

Brown, Campione and Day (1981) also investigated three variations of explicitness: 1) in blind training, students were told to use a strategy; 2) in informed training, students were told to use a strategy and how it would help their learning; and 3) in self-controlled training, students were shown how to use the strategy as well as how to monitor and evaluate their strategy use. They were also told how the strategy would help their learning. The report suggests that the more explicit the training was the more powerful its effect on performance.

Dansereau (1985) also considers modeling (the demonstration of strategy use) in conjunction with feedback on learner output as important components of training. Further, Babbs and Moe (1983) reported that explicit instruction, which included specific directions, demonstrations of strategy use, and planned practice is beneficial to the young. Burger, Blackburn, Holmes, and Zetlin (1978) found similar results in a study using young children. Those subjects who were trained to actively sort and cluster pictures had significantly improved recall over those who did not. Other researchers have found similar results (Pressley, 1984; Butterfield & Belmont, 1977; Canelos & Taylor, 1981).

The research on learning strategy training suggests several components as necessary for effective teaching of strategies. These are as follows:

1. Demonstrating correct strategy usage.
2. Providing an explanation of its utility in learning a task.
3. Planning for active participation and practice by the student.
4. Providing for feedback on performance.

Overall, findings from these studies suggest that explicit training in strategy usage is more powerful than simply telling students to use a strategy. However, both types of instruction tended to produce better performance than no strategy instruction at all.

While it appears that students can be trained to use strategies, the generalization or transfer effects have yet to be found in the literature (Canelos, 1979; Brown, 1981; Weinstein, et al., 1978, 1979; Dansereau, 1978). Lawson (1980) states that while the promise of benefits from training appear obvious, those realized thus far have been disappointing. This may be due to other influencing factors within the instructional environment.

Learning Strategies and Individual Differences

The application of stratgies may be affected by individual differences among learners. To date, most studies that assess strategy training have not looked at the interaction with individual differences (Dansereau, 1985, p. 215). While there is potential for many types of individual differences, such as level of motivation, task persistence, or locus of control, to affect learning strategy usage, it may be reasonable to begin with the two learner characteristics which are most extensively researched. Age and general ability may be the learner characteristics that interact with the teaching of the learning strategies.

In general, younger students use strategies less effectively than older students (Brown & Smiley, 1978; Kail, 1979). Research has shown that children can be trained as early as fourth grade to use strategies in an instructional task; however, they do not use strategies to the fullest extent (Babbs & Moe, 1983; Burger et al, 1978; Reinking, 1983). This may be due to the level of cognitive development; prior to age eleven, children are not mentally ready to engage in effective strategy use. The mental development of an individual increases with age and levels off at adulthood (Kail, 1979).

Research investigating general ability as a factor showed that mentally handicapped subjects could be trained successfully to use a strategy. Despite an increase in learning performance, however, transfer from one task to another did not occur (Brown, Campione & Day, 1981). Students in a normal ability range outperformed mentally handicapped children of the same age (Burger, et al., 1978). Rohwer (1981) has shown that higher ability students have a greater capacity for generating strategies than those of lesser ability. More research is needed on the effects of providing training in learning strategies to students of differing intelligence levels.

Learning Strategies and the Instructional Outcomes

The type of instructional outcome may also affect the training in and transfer of learning strategies. Much of the research on learning strategies has focused on verbal information outcomes; that is, instruction that is concerned with memorizing a number sequence or a vocabulary word list, or sorting pictures (Canelos & Taylor, 1981; Weinstien, 1978; Burger, et al, 1978; Pressley, 1983). According to Gagne's hierarchy of instructional tasks, verbal information is at the lowest level of learning outcomes.

At the highest level is problem solving, or in Gagne's terms higher order rules. Problem solving requires learners to combine rules in some unique manner to arrive at the unique solution (Dick & Carey, 1985). Research investigating problem solving strategies may be associated with such techniques as brainstorming, Socratic method, means-end analysis, and incubation (Anderson, 1980b; Rummelhart & Norman, 1981).

However, a more central component of school learning is concept acquisition. Gagne states that the majority of information learned in school is comprised of concepts. Of particular interest to this investigation, are strategies that can be linked to concept acquisition tasks. Very little has been reported about learning strategies in conjunction with concept attainment.

Early studies by Rosco and associates investigated use of mental imagery in concept attainment with significant results (Rosco, Tennyson, & Boutwell, 1973; 1975). Carrier, Joseph, Krey and LaCroix (1983) found that sixth grade students who were instructed to generate their own images performed significantly better on a concept attainment task than did those who were supplied with visuals. There was no verification other than test performance to indicate whether students used the strategy.

Using twelfth grade subjects, Park (1984) found that instructing students to compare examples was more effective on posttest performance than having them concentrate on attribute identification. However, the study did not investigate whether or not students would generate images on their own without directions to do so.

Finally Allen (1982) using a concept task, also asked subjects to create their own examples which were to be similar to and distinct from the concept prototype. While the results of his dissertation study did not reach statistically significant levels, there was a trend toward improved performance for those subjects who generated their own examples over those who were assigned examples.

In studies involving concept acquisition tasks, there is some indication that having students manipulate examples leads to improved test performance. However, these studies were conducted with little or no explicit training in strategy use.

## Purpose of the Study

The primary purpose of this study was to investigate the potential individual and combinatorial effects of learning strategy training, and ability on children's acquisition of new concepts. A second purpose was to determine if use of the strategy, generation of examples, would transfer to new concept lessons once the training had been completed. In an effort to relate the literature review to the study, the hypotheses, research questions, and related implications are presented below.

### Hypothesis One

There would be a main effect for training. Subjects with explicit training would have significantly higher posttest scores for lessons than those in either the informed or no training treatments.

Research Question. Which type of learning strategy training is most effective for use with concept acquisition?

Reported results indicate that not all students use learning strategies appropriately, and that they need to be taught to learn and use learning strategies effectively. Klausmeier (1985) and Tennyson and Cocchiarella (1986) advocate the development of a strategy for assisting learners in their concept acquisition be included in the instructional design. However, there is a paucity of empirical research on such training and use as it relates specifically to concept acquisition.

It has been found that strategy training which provides explicit directions, a demonstration of strategy use, and provisions for practice with feedback should result in improved test performance of various instructional tasks. It is reasonable to assume that such training would lead to improved performance on concept attainment tasks.

Hypothesis Two

There would be a main effect for ability. Subjects of higher ability would have significantly higher posttest scores than those of lesser ability.

Research Question. How does ability affect performance and the use of learning strategies?

In general, it has been found that students of higher ability are more capable of engaging effectively in instructional tasks and attain higher performance scores than lesser ability students. It has also been reported that the higher ability learners are able to generate and use strategies effectively when interacting with instructional materials while lower ability students do not. Because ability is a relatively stable trait among learners, it is likely that similar results would occur in this investigation.

Hypothesis Three

There would be an ordinal interaction between treatment and ability. The lesser ability subjects receiving the training would outperform those of the same ability level who received either the informed or no training treatment. However, higher ability subjects in the three treatment groups would do comparably well on posttests.

Research Question. How does ability interact with differing levels of instruction in learning strategy use?

Dansereau (1985) states that most studies examining methods of strategy training have not investigated the interaction of training and individual differences. To extend the research, this investigation studied the interactive effects of differing

levels of ability within the normal range of intelligence and strategy training and use.

Drawing upon the research related to ability by treatment interactions (ATI), it has been found that low ability students are assisted by explicit instruction more than higher ability ones. In addition ATI research suggests that simple instructional support often is useless or even detrimental to high ability students (Snow & Peterson, 1981; Cronbach & Snow, 1981). This study was designed to investigate whether the selected strategy training methods would assist lesser ability students without hindering higher ability students.

Hypothesis Four

Those subjects who received explicit training will outperform subjects in the other treatments in the concept lessons in the transfer sessions.

Research Question. Will learning strategy use transfer to new situations after training?

Findings suggest that transfer is promoted by trying to provide some common elements of the initial situation within the new situations. Transfer is also enhanced by identifying the utility of strategy use to the new situation (Clark & Voogel, 1985; Cronbach, 1977). Derry and Murphy (1986) advocate using an unobtrusive prompt within the instruction to assist transfer to new situations.

## Methodology

### Sample

Subjects were drawn from an initial pool of 178 sixth grade students in two middle schools in the upper midwest. There were 102 boys and 76 girls. They were approximately twelve years old at the time the study was conducted.

### Treatments

The differences in the three treatment conditions were based on the amount of training subjects received for the learning strategy, self-generation of examples. The explicit training (ET)subjects were taught to generate their own examples. The training consisted of experimenter modeling, student practice, and corrective feedback on the students' own verbal and visual examples of the concept that were drawn on scratch paper.

The informed directions (ID) treatment were merely directed students to make up their examples of the concepts taught. They

were told that they could use the scratch paper to write or draw their examples. However, no modeling, practice, or feedback was provided.

The no training (NT) treatment group did not receive training in or information on strategy use. For consistency, they also received the scratch paper, but told to use it if they needed to do so. They read the content narratives and completed the activity.

Treatment materials

Five concept lessons were developed as the instructional materials. The five topical areas taught were prepositional phrases, clouds, propaganda techniques, context clues, and mollusk shells. With the exception of the lesson on prepositional phrases, all were coordinate concept lessons. A coordinate concept lesson is one that contains a superordinate concept and two or more subordinate concepts. While these subcategories share common critical attributes of the main classification, they also have distinct characteristics of their own. They were designed according to the procedures prescribed by Tennyson and Cocchiarella (1986) and Merrill and Tennyson (1977). They were self-paced, self-instructional materials in a written format.

Content narratives were provided for the NT treatment group during the first three sessions. These brief passages were the placebo lessons on the topics of prepositional phrases, clouds, and propaganda techniques. The reading of the content narrative and completion of a short exercise were used as means of controlling for the time.

Instruments

Several instruments were used to measure the various independent and dependent variables. Ability was measured by the Cognitive Skills Index of the national standardized test, the Tests of Cognitive Skills (CTB-McGraw, 1982).

Concept achievement was assessed by a total of nine posttests. There were three lesson posttests, two immediate posttests, two delayed posttests, and two retention tests. They employed a multiple choice, paper and pencil format.

Scratch paper was provided as a means to determine whether a learning strategy was used in the experiment. An opinion survey was a supplemental measure used to obtain student perceptions of the lessons, their effort, and their strategy use.

Procedures

A pilot test of the materials and procedures was conducted. Based on the results, one lesson was deemed unsuitable content for the age level and thus replaced. The remaining lessons were corrected for typographical and spelling errors. The time allotted for the lesson was increased to about an hour. While ambivalent at best, the results warranted further investigation of learning strategy use but with a larger sample size.

Subjects within each classroom were randomly assigned to the three treatment conditions. One week before the experiment was to begin, the experimenter visited each classroom to make introductions, explain the procedures, and address any questions that students had regarding the study. At that time, subjects were told that their participation would not affect their school grades and that all information would be kept confidential and anonymous. A list of students assigned to the three treatments was given to each classroom teacher so that students would be ready for the first session the following week.

The study consisted of two parts: training sessions and transfer sessions. The sessions occurred over a period of six weeks towards the end of the school year. A chart demonstrating the sequence of the instructional presentation is shown in Figure 1.01. There were three one-hour lessons in the first part of the study, the training sessions. At that time, the ET and the ID treatment groups were explicitly trained or informed on the strategy (described previously). The lessons were immediately followed by a lesson posttest. At the same time, the NT treatment group remained with the classroom teacher and received the content narratives; they did not receive a lesson posttest. Prior to conducting each session, experimenters and classroom teachers received written directions.

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Figure 1.01 about here.

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The transfer sessions were the last half of the study. They were designed to test and compare the effects of transfer of the learning strategy training for the two experimental treatments against the NT treatment group. Subjects from all three treatments were grouped together in the classroom for two sessions of approximately one hour in length. They received the same directions, instructional materials, and tests. A final session of approximately one-half hour was conducted to administer the delayed posttests, retention tests, and the opinion survey. A third experimenter delivered the directions

during these sessions to control for any potential experimenter bias.

Design

The study employed a one-way factorial design with three treatment conditions. The dependent variables were analyzed using a multivariate analysis of covariance. A repeated measures design was employed on the three training session tests and the six transfer session tests. The covariate, ability, was assessed by the composite scores on a test of mental ability.

Data Analyses

A multivariate analysis of covariance (MANCOVA) was conducted on the scores from the immediate posttests administered to the two experimental groups during the training sessions. MANCOVAs also were conducted on the performance scores for the immediate and delayed postests and the retention tests of the lessons in the transfer sessions. Univariate ANCOVAs were run for those main effects or interactions which reached significance. A cross tabulation was completed on the secondary dependent measures, the scratch paper, and the opinion survey items as a means for comparison with test performance and evidence of strategy use.

Data analyses were conducted to yield reliability estimates on the posttests, descriptive statistics on the ability of the subjects and performance measures, and tests of the formal hypotheses.

## Results

Reliability

Satisfactory but moderate relability estimates were found on each of the immediate, delayed and retention posttests. Item analyses on an immediate posttest indicated that some items did not discriminate well; the rest were considered good discriminators. Because of the poor items, the relability of the tests was probably lessened.

Descriptive Statistics

The mean of the lesson posttest scores and the standard deviations were similar for all groups. Table 1.01 shows the scores for the ET and ID treatment groups for the three lessons during the training sessions. Mastery of the concepts was at about fifty percent.

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Table 1.01 about here.

Table 1.02 shows the scores for all three treatments for the Context Clues lesson given during the transfer session. Again the mean postest scores and the standard deviations were not significantly different from each other. It is interesting to note that the NT group means was higher than the other two groups.

Similar results can be seen in the scores for the Mollusk Shells lesson in Table 1.03. Again there were no statistically significant differences among treatments.

Tables 1.02 & 1.03 about here.

Pearson Product-Moment Correlation

Correlations showed that ability correlated with the tests. Also Table 1.04 shows that the nine posttests correlated with each other in general.

Table 1.04 about here.

Formal Test of Hypotheses

Two statistical assumptions were tested before each of the MANCOVAs was conducted. First, the Bartlett-Box M test for homogeneity of variance/covariance matrices and, second, a test of homogeneity on the regression slope for CSI ability across cells were conducted. These revealed no significant difference and also meant that there was no aptitude by treatment interaction as hypothesized.

A third preliminary test for order effect on the performance measures of the transfer sessions was conducted. Because each of the sets of performance measures was given to half the subjects in a different sequence, a test for order effect had to be conducted before the data could be pooled. It was not significant, Wilk's lambda .98 and $F$ (4, 151) = .85, $p$ = .50. Thus the various performance measures could be combined for the statistical analyses.

The following were the findings of this investigation. While there the ET posttest scores were slightly higher than the

ID scores in the training sessions, there was no statistically significant difference among treatment condition posttest scores.

The ET treatment used the learning strategy in the training session, but showed a significant drop in strategy use during the transfer sessions. The use of the learning strategy was minimal by the ID treatment group and almost nonexistent by the NT group; this usage was consistent in both the training and transfer session. Thus it is not surprising that strategy training had no significant effect on performance of the transfer session posttests.

Ability was found to correlate significantly with performance (See Table 1.05). However, there was no significant difference in strategy use between high and low ability students.

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Table 1.05 about here.

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The opinion survey indicated a variety of student preferences for lessons. There also was a variety of opinions as to which lesson was most difficult. The majority of students placed themselves in the top two rankings of work effort, "did their best" or "good job." The subjects also seemed to accurately report their use, or more appropriately, their lack of use, of the learning strategy. This was confirmed by a comparison with the actual scratch paper on which they generated their example.

## Discussion and Conclusions

It is not, of course, surprising to discover that in both the training and transfer sessions, higher ability students performed significantly better on posttests than lower ability students. The literature on ability is replete with research findings suggesting that, in general, higher ability students will outperform lower ability students (Snow & Peterson, 1981; Cronbach & Snow, 1977). This study is in agreement with that general conclusion. The remaining hypotheses of the investigation were not supported. Although the general lack of significant results precludes drawing definitive conclusions, some tenative ones are warranted based on the findings of this study.

### Training in Learning Strategy Use

Research on learning strategies has shown that students can be trained in learning strategies and that such training can lead to improved test performance (Weinstein & Mayer, 1985; Rigney, 1980; Dansereau, 1985). However, the results of this study failed to demonstrate that such explicit training enables

students to employ learning strategies effectively. This lack of support for the general consensus on strategy training may be due to methodological rather than conceptual reasons. In other words, it remains a defensible claim that training in learning strategies may result in improved performance on concept learning tasks, but specific elements in the design of the lesson materials and in the execution of this study may have contributed to the lack of significant results in the treatments.

Among the factors that may have contributed to the failure to obtain results are the following:

1. The students may not have been developmentally ready to capitalize on the strategy training. While research suggests that children beyond age eleven actively engage in strategy use (Kail, 1979; Flavell, 1977), these particular subjects still may not have had the mature mental capacity to engage effectively in strategy use. Brown and Smiley's (1977) study found that twelfth grade students (seventeen years old) activated strategies to their fullest extent, while seventh grade students (twelve years old) used strategies less effectively. Perhaps a sample of older students would have yielded stronger results.

2. Students may simply not have received enough training in strategy use. When one considers the claim of many learning strategy researchers that before students can benefit from learning strategies in an instructional situation, these strategies must first exist within the individual (Shuell, 1980; Rigney, 1980), it is plausible that a series of three lessons may do very little to compensate for this lack. Students may not have had sufficient time to acquire the strategy. Perhaps training sessions of longer duration may increase the overall effectiveness of strategy acquisition and use.

3. The strategy itself may not have contributed to the attainment of concepts presented. That is, despite the best effort of the investigator to construct a learning strategy that directly aided the attainment of concepts, the strategy investigated in this study may have produced a kind of cognitive overload that confused rather than aided the students. The generation of examples may have competed with the instructional task demands and therefore impeded concentration. While research suggests that example imagery may assist learners in acquisition of the new concepts (Rosco, et al, 1973; 1975; Allen, 1982), the added requirement of putting the example on paper may have discouraged its use.

In addition, the chosen strategy may have interfered with strategies already established by the subjects. Thus, there may have been a second type of competition between the two. It may

be fruitful to explore other types of strategies used by students.

4. The specific qualities of the lesson may have contributed to the lack of significant results. The lower mean posttest scores for all students in the study raise the possibility that these materials may have been more difficult than anticipated. Even though the difficulty of the lessons was adjusted, based on the pilot study results, further modifications may be necessary.

Transfer of Learning Strategy Use.

Transfer, in general, is very difficult to implement and to investigate (Gagne & Briggs, 1979; Clark & Voogel, 1985; Gagne, 1986). It has yet to be found conclusively in the research on learning strategy generation and use (Weinstein, 1982; Lawson, 1980). Therefore, failure to show transfer in this investigation, although disappointing, may not be that surprising.

1. There may not have been a clear enough connection for students between the training sessions and the transfer sessions. Students may not have had sufficient cues to apply the learning strategy. Derry and Murphy (1986) suggest that an unobtrusive prompt be employed in the new situations to cue learners to use the strategy. Although the experimenter reminded students to use the paper, as they did in the training sessions, and the scratch paper itself was a physical reminder, these prompts may have been too vague for students.

2. Students who received the explicit training (ET) on strategy use may have had less time to complete the actual lesson than those in the other two treatments. As an experimental control, all treatments had the same amount of time to complete the lessons. The ET treatment group had far more work to do since they had to construct concept examples on paper. These students may have elected just to complete the lesson task and not opt to use the strategy. Perhaps allowing more time within the lesson would have allowed students to both use the strategy and complete the task.

3. The results also indicated a significant drop in strategy use among the ET group from the training sessions to the transfer sessions. Thus it may be necessary to require that students in this treatment use the strategy so that a better comparison of performance with the no training group can be obtained.

4. Finally, the overall conditions of the instructional setting may also have influenced the outcome of transfer. The

study was conducted at the end of the school year, when culminating activities of the school and classroom may have taken up much of the students' attention and interest. In addition, the investigation was not a part of the regular classroom routine and students knew that performance would not affect their grades. These conditions may have created artifical setting and interfered with students' participation in the study. Perhaps incorporating learning strategy training within the curriculum would be more effective.

## Implications for Future Research

The questions examined in this study are important ones for those concerned with students' ability to generate and use strategies in order to become self sufficient learners. Despite the ambiguous results of this study, it is possible that training in learning strategies may indeed effectively facilitate the acquisition of new concepts. Further research is need to investigate this claim. Such research could proceed in several directions.

First, a beginning point for future research might be to make revisions suggested earlier and conduct a similar study. More reliable measures for assessing students' performance need to be developed. Treatment materials need to be revised to lessen the difficulty for this particular age group. Training time may need to be increased and the use of the learning strategy might be required during the transfer sessions.

Second, further research should examine the variations of strategies employed by students. The types of learning strategies that are most effective with concept learning need to be determined. Subsequent investigations may need to use qualitative methods, such as "think alouds" and interviews, to discover the heuristic strategies that students already employ.

Third, further research should investigate the variations of strategy training. For example, the specific components of the training need to be examined in order to determine their impact on strategy acquisition and use. Studies might investigate the examples used in demonstrating a particular strategy, or the amount of practice necessary for student to acquire the strategy, or the amount and type of feedback used in the training of strategy use.

Fourth, longitudinal studies are needed to investigate the effect of extended training in strategy use on students' acquisition of new concepts. This might be conducted in the form of experimental curricula that incorporates strategy training within a content area. It might be necessary to train teachers

in strategy use in order to incorporate the investigation within a regular classroom situation.

Fifth, further investigation should be made into the relationship between ability and strategy training. This research might supply answers to inquiries about how strategies can better serve lower ability students without hindering higher ability students who may already possess strategies and use them effectively. In addition, studies need to consider the effects of strategy training on the middle range of ability as well as the extremes. Such a study could provide practical information in how to implement strategy training into the more typical classroom setting.

Sixth, because the investigation of interactions of strategy training and individual differences is a new area of research (Dansereau, 1985), no definitive conclusions could be made from the findings of the present investigation. However, it is a beginning. More research is needed on the effects of strategy training and uses as they relate to other learner characteristics.

Finally, continued efforts need to be made to understand the transfer effect of strategy training. A study could be devised to investigate the type of prompting needed to envoke strategy use in new situations. The amount and the duration of prompting are also important factors to be investigated.

In summary, the variations and extensions the study just described imply directions for future research. Such studies could suggest ways to train student to use strategies effectively, and thus become self sufficient, competent learners.

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Figure 1.01

Schedule for the Training and Transfer Sessions

| Sessions: | Training | | | Transfer | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6* |
| Treatment: | | | | | | |
| ET | PP 1 | CL 1 | PT 1 | CC 2 | CC 3 MS 2 | MS 3 CC 4 |
| | | | | MS 2 | MS 3 CC 2 | CC 3 MS 4 |
| ID | PP 1 | CL 1 | PT 1 | CC 2 | CC 3 MS 2 | MS 3 CC 4 |
| | | | | MS 2 | MS 3 CC 2 | CC 3 MS 4 |
| NT | CN 0 | CN 0 | CN 0 | CC 2 | CC 3 MS 2 | MS 3 CC 4 |
| | | | | MS 2 | CC 3 MS 2 | MS 3 CC 4 |

* No lessons in Session 6; only tests and opinion survey.

LESSONS: PP = Prepositional Phrases
CL = Clouds
PT = Propaganda Techniques
CC = Context Clues
MS = Mollusk Shells
CN = Content Narratives on same topic

TESTS: 0 = no test given
1 = lesson
2 = immediate
3 = delayed
4 = retention

Table 1.01

Means and Standard Deviations for
Performance Measures for Training Session Lessons

| Lesson Posttests | Treatments ET | ID | Total |
|---|---|---|---|
| Prepositional Phrases* | | | |
| M | 6.2 | 5.5 | 5.9 |
| SD | 1.7 | 1.5 | 1.6 |
| n | 47 | 46 | 93 |
| Clouds** | | | |
| M | 7.0 | 6.1 | 6.6 |
| SD | 2.7 | 2.7 | 2.7 |
| n | 47 | 46 | 93 |
| Propaganda Techniques** | | | |
| M | 6.7 | 6.4 | 6.6 |
| SD | 2.3 | 2.4 | 2.4 |
| n | 58 | 60 | 118 |

* Maximum score = 10 items on the post test.
** Maximum score = 12 items on the post test.

Table 1.02

Means and Standard Deviations
for Test Scores for the Context Clues Lesson

| | Treatments | | | |
|---|---|---|---|---|
| Test | ET | ID | NT | Total |
| Immediate Posttest I* | | | | |
| M | 10.4 | 10.1 | 10.5 | 10.3 |
| SD | 2.9 | 3.4 | 3.1 | 3.1 |
| n | 55 | 50 | 51 | 156 |
| Delayed Posttest I* | | | | |
| M | 9.3 | 10.1 | 10.0 | 9.8 |
| SD | 4.0 | 3.8 | 4.2 | 4.0 |
| n | 55 | 50 | 51 | 156 |
| Retention Test I* | | | | |
| M | 9.3 | 8.9 | 10.0 | 9.4 |
| SD | 3.1 | 3.1 | 3.0 | 3.1 |
| n** | 27 | 22 | 26 | 75 |

* Maximum score = 20 items per test
** Numbers show that approximately half of the subjects were randomly sampled within each treatment group to complete the test.

Table 1.03

Means and Standard Deviations
for Test Scores for Mollusk Shells Lesson

| Tests | Treatments ET | ID | NT | Total |
|---|---|---|---|---|
| Immediate Posttest II* | | | | |
| M | 9.1 | 9.0 | 8.7 | 9.0 |
| SD | 4.2 | 3.5 | 3.7 | 3.8 |
| n | 55 | 50 | 51 | 156 |
| Delayed Posttest II* | | | | |
| M | 8.8 | 8.7 | 8.3 | 8.6 |
| SD | 4.2 | 3.5 | 3.5 | 3.7 |
| n | 55 | 50 | 51 | 156 |
| Retention Test II* | | | | |
| M | 7.9 | 7.4 | 8.8 | 8.1 |
| SD | 3.9 | 3.5 | 3.5 | 3.6 |
| n** | 27 | 26 | 25 | 78 |

* Maximum score = 20 items per test
** Numbers show that approximately half of the subjects were randomly sampled within each treatment group to complete the test.

Table 1.04

Pearson Product-Moment Correlations
Among Cognitive Skills Index & Performance Measures

| TEST | PPL | CL | PTL | CCI | CCD | CCR | MSI | MSD | MSR |
|---|---|---|---|---|---|---|---|---|---|
| Cognitive Skills Index | .32a<br>(105)b<br>.001c | .50<br>(111)<br>.001 | .48<br>(110)<br>.001 | .46<br>(162)<br>.001 | .35<br>(158)<br>.001 | .29<br>( 74)<br>.007 | .51<br>(163)<br>.001 | .50<br>(158)<br>.001 | .35<br>( 75)<br>.001 |
| Prepositional Phrase Lesson | | .34<br>(111)<br>.001 | .29<br>(110)<br>.001 | .25<br>(105)<br>.004 | .25<br>(103)<br>.006 | .06<br>( 45)<br>.35 | .27<br>(109)<br>.003 | .34<br>(106)<br>.001 | .22<br>( 52)<br>.06 |
| Clouds Lesson | | | .32<br>(117)<br>.001 | .32<br>(114)<br>.001 | .26<br>(109)<br>.003 | .27<br>( 51)<br>.03 | .47<br>(116)<br>.001 | .40<br>(113)<br>.001 | .55<br>( 52)<br>.001 |
| Propaganda Techniques Lesson | | | | .41<br>(114)<br>.001 | .40<br>(108)<br>.001 | .40<br>( 50)<br>.002 | .36<br>(115)<br>.001 | .40<br>(112)<br>.001 | .33<br>( 52)<br>.008 |
| Context Clues Immediate | | | | | .51<br>(163)<br>.001 | .58<br>( 77)<br>.001 | .37<br>(168)<br>.001 | .38<br>(163)<br>.001 | .32<br>( 77)<br>.002 |
| Context Clues Delayed | | | | | | .48<br>( 78)<br>.001 | .30<br>(163)<br>.001 | .35<br>(158)<br>.001 | .42<br>( 78)<br>.001 |
| Context Clues Retention | | | | | | | .13<br>( 78)<br>.125 | .01<br>( 78)<br>.47 | N/A |
| Mollusk Shells Immediate | | | | | | | | .56<br>(167)<br>.001 | .63<br>( 78)<br>.001 |
| Mollusk Shells Delayed | | | | | | | | | .65<br>( 77)<br>.001 |

a = Pearson Correlation Coefficient
b = number of subjects
c = p value

N/A = Different subject samples for each test

Table 1.05

Univariate Analyses of Ability Effects
on Performance Measure Scores

| Test | MS | DF | F | P-value |
|---|---|---|---|---|
| Prepositional Phrase | 2.15 | (1,99) | 12.31 | <.001 |
| Clouds | 5.38 | (1,99) | 35.76 | <.001 |
| Propaganda Techniques | 4.41 | (1,99) | 29.16 | <.001 |
| Context Clues | | | | |
| Immediate I | 7.49 | (1,145) | 43.65 | <.001 |
| Delayed I | 14.00 | (1,145) | 22.46 | <.001 |
| Retention I | 59.66 | (1,70) | 6.92 | .01 |
| Mollusk Shells | | | | |
| Immediate II | 10.57 | (1,145) | 51.58 | <.001 |
| Delayed II | 11.03 | (1,145) | 44.85 | <.001 |
| Retention II | 129.93 | (1,71) | 11.22 | .001 |